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THE LINGERING ADMIRERS OF PHRENOLOGY.

BY PROF. CLELAND.

To slay those that are already slain may be excellent sport to employ the courage of a Falstaff, but the reader perusing the title of this article may perhaps be disposed to ask why the pages of this review should be occupied with the discussion of so dead a doctrine as Phrenology. The answer is, that although phrenology never had much countenance from scientific men, and has long since been banished by them, with one consent, to the limbo of exploded chimeras, yet among educated men and women not physiologists, and not pretending to know anything about anatomy, it still holds its grounds wonderfully, and counts considerable numbers of people who believe in its miraculous skull maps; while, besides these, there is a far more numerous class of persons, including, undeniably, a certain proportion of scientific men, who, admitting that the minute division of the cranial vault into organs is untenable, yet profess belief in a larger mapping, and have no hesitation in relegating the reasoning faculties exclusively to the forehead, and the moral sentiments and volitionary powers to other parts of the brain-pan.

This state of matter does not exist without a sufficient reason to account for it. Long before the time of Gall and Spurzheim, men were in the habit, sometimes consciously, and much more frequently half unconsciously, of gauging the intelligence and moral qualities of their neighbors by their personal appearance generally, and more particularly of estimating them according to crude impressions derived from the shapes of their heads. They judged rightly enough that there was some connection between brain and mind. Much of the evidence that the brain is the organ of the mind is so palpable that it could not remain long hid. The effects

of injuries and diseases of the brain in disturbing the intelligence, its larger size in the higher than in the lower classes of animals, and more especially its distinctively great development in man: these circumstances, together with the indubitable frequency of finely proportioned heads among persons of distinguished talent, and the tendency of the eye to dwell on clumsy or forbidding proportions, when occurring in persons brought under notice as stupid and depraved, all seemed, though vaguely, to point out that a scrutiny of the amount of the brain and shape of the cranium was likely to afford an index of the strength and qualities of the mind. Gall propounded his theory that different portions of the brain were the organs of different mental faculties, and that according to the size of those different parts of the brain, so the mental qualities varied; and making continual observations on the heads and characters of those with whom he came in contact, he covered the surface of the cranial vault with a map, which at once professed to indicate the correct analysis of the mental faculties, and to assign to each of these its proper habitation. The psychological difficulties of their pursuit do not seem to have weighed heavily on either Gall or his followers; and as for the exceedingly great obstacles in the way of estimating the proportions of even large masses of the brain by observation of the surface of the skull, not only did the phrenologists strangely ignore them, but we are constrained to say that even anatomists have been very slow to appreciate them. Phrenology, however, supplied a want which the public felt, seeming to furnish an answer to questions which were continually obtruded before them, and giving precision to the notions founded on fact which had previously possessed their minds: this, we believe, is the principal reason why phrenology became so popular as it did, and why it is not yet eradicated from the public mind.

Probably scientific men, in dealing with phrenology, have been too much in the habit of contenting themselves with

merely pointing out that the system is certainly a blunder; and their hearers have gone away impressed with the conviction that it is impossible for the uninitiated to argue with experts, yet saying in their hearts that they are sure there is a mistake somewhere, and unwilling to part with all their beautiful theories and get nothing in exchange. Iconoclasm is not popular: when an image is thrown down it is well that its destruction should make way for a flood of light sufficient to satisfy the eye in its stead. This is an achievement not easy to accomplish, but actuated with the laudable motive of attempting it, the writer will try, not only to reiterate the reasons why phrenology cannot possibly be true, but to give some idea of what is positively known regarding the brain and its functions, and to point out in what direction speculation may be still legitimately indulged.

Let us begin at the beginning and try and form some general notion of what the brain is as it is known to the anatomist, before we dogmatize about the functions of the parts which happen to come in contact with the upper and lateral walls of the skull.

If a chick be examined in a hen's egg which has been allowed to hatch for twelve hours, or if the embryo of any vertebrate animal be examined at a similarly early period, it will be seen to exhibit a long open furrow, the walls of which are the first portions of the animal to be formed. The most superficial layer of substance entering into the construction of this furrow may be described as a long ribbon, consisting of two symmetrical parts separated by a longitudinal groove: this is the embryo brain and spinal chord, constituting one continuous structure, the cerebrospinal axis. The parts which support the ribbon form in like manner the cranium and the spinal canal, primarily undistinguishable one from the other. The edges of the furrow rise up and become united, so that the open furrow is converted into a closed cylinder; and similarly the ribbon within it has its lateral edges brought together, so that the brain and spinal cord

at an early period of their development, form one continuous tube. The walls of the tube so formed become ultimately much thickened and exhibit two kinds of texture, which, from their color, are distinguished as the gray and the white. In the case of so much of the tube as lies in the spinal canal and is afterwards termed spinal cord, the development proceeds very regularly; white matter is deposited on the outer wall of the cylinder, and gray matter on the inner wall, until it appears solid. A minute canal, however, the central canal of the spinal cord, continues to traverse its whole extent throughout life, and is the remains of the original hollow of the tube. Towards the lower part of the cord in birds there is even a space called the sinus rhomboidalis, where the cylinder is never completed, and the central canal is open on the dorsal aspect. Now, however different the brain may be in the adult condition from the spinal cord, it is extremely interesting to note that it is the anterior portion of the same cylinder, but that the cylinder undergoes some bendings, its walls are greatly thickened in some places and imperfect in others, and the continuation of the central canal is in some places greatly dilated, and in others contracted.

As respects texture, there is much in common between the brain and spinal cord. They are similar in appearance, and both consist of true nerve tissues, with a fine reticulum of supporting substance in which those more important elements are embedded. The proper nerve tissues are two in number, nerve fibres and nerve corpuscles: the nerve fibres are long threads which have the property of transmitting along their course a certain change of condition which constitutes nervous influence, and which, it may be mentioned, is a purely physical action, not electrical, but involving in its operation electrical changes. Nerve fibres transmit this influence, but have no power of originating, directing, or modifying it: they are simply conductors, and such nerve fibres are the essential elements in all the nerves throughout

the body. Nerve corpuscles are bodies of which it is only necessary to say that they present a variable number of poles or branches, and there is no reasonable doubt that these poles are in direct continuity with nerve fibres. According to circumstances little understood, these corpuscles have the property of modifying impressions or nervous influence, and of directing them into different channels with which their poles communicate. Now the white substance of the brain and spinal cord contains only nerve-fibres without any nerve corpuscles, these latter being found exclusively in the gray substance. It is quite plain, therefore, and universally recognized, that the white substance is only useful as containing channels of communication between different parts of the gray, and also between the gray substance and the muscles and sensitive parts throughout the body. But even the gray substance is not always or even generally capable of being affected directly by the consciousness; and in the case of the spinal cord, it is very certain that consciousness resides in no part of it, either white or gray. The spinal cord is the centre with which are connected the nerves of the muscles and integuments of the greater part of the body, and in the ordinary actions of the body what usually happens is this, that impressions made by the contact of external objects on the terminations of sensory nerves in the integument are transmitted by them to the nerve corpuscles of the cord, and, through series of these, conducted to the parts of the brain, which are in immediate connection with consciousness; while also, when the mind wills certain movements of the body, the stimulus proceeds from those parts of the brain, and, by some altogether unknown mechanism, is ultimately so distributed that there extend from the gray matter of the cord impressions along the nerves so adjusted as to produce precisely that amount of contraction of muscles, of whose existence the mind is utterly ignorant, which is necessary to effect the required result. But it is always the same kind of stimulus, the nervous influence, wherever

it issues from, which acts upon the cord. Thus, for example, when the cord near its upper part is severed from the brain by an injury, there is loss of all sensation and voluntary motion in the parts supplied by it below the place of lesion, the consciousness being no longer in communication with those parts; but irritation of the integument still sends a current as before to the spinal cord, and this being distributed by the corpuscles of the gray matter, and descending again by the motor nerves, causes involuntary contraction of muscles. This is probably the simplest possible example of the phenomenon termed by physiologists reflex nervous action.

We have ventured on this extremely cursory and general survey of the spinal cord, the simplest portion of the cerebrospinal axis, in order that the general reader may form some conception of the kind of mechanism which extends through the more obscure and intricate portion, the brain. To explain fully the extremely complex structure of the brain would require much greater detail than is allowable in an article like this, but a general idea of the most important facts will best be arrived at by pursuing the account of its early development, which we have already begun.

The cylinder which we have traced in the embryo, so far as the spinal cord is concerned, is immediately on its closure, expanded in its cranial part into a series of three primordial vesicles, and immediately afterwards two little hollow buds, called the hemisphere vesicles, project laterally from the foremost of the series. Without tracing the history of the primordial vesicles, it is sufficient for our present purpose to point out that the cerebellum is originally a part of the hindermost, projecting upwards as a hollow pouch, and that it is quite certain, from the experiments on lower animals, that no consciousness whatever resides in any of the parts developed from that vesicle; also it is equally certain that not more than the very feeblest consciousness resides in those parts into which the walls of the two other primordial vesicles

cles are developed. These parts are devoted to the carrying on of obscure functions connected with the sensibility and movements of the body strictly comparable with the functions of the spinal cord, and entirely of a physical description: the organs of the mental faculties are the developed hemisphere vesicles, and these only. The hemisphere vesicles rapidly enlarge and extend backwards over and around the other parts of the brain, so as to reach to the cerebellum behind, come in contact with the whole roof and sides of the skull and a large part of its floor, and press one against the other in the middle line of the whole length of the skull for an average depth of a couple of inches; and early in embryonic life they are already much the most bulky parts of the brain.

The gray matter which lines the whole length of the cerebrospinal cylinder fails to be developed in the hemisphere vesicles, except at one part placed at the neck of the vesicle, and called by anatomists the corpus striatum, but of which we know nothing in respect of function, and can only note that it is traversed by the whole mass of fibres joining the hemisphere vesicles with the cord and cerebellum. The whole of the rest of the hemisphere vesicle, or, as it is termed, the cerebral hemisphere, consists of an enormous mass of white matter, with a superadded layer of gray matter on the outside. The cerebellum has the same peculiarity of having its gray matter on the surface, and it is curious to note that both the gray matter on the cerebellum and that on the cerebrum, while differing one from the other in minute structure, differ still more from the gray matter which is found elsewhere, and the function of which is, as we have seen, in a general way, well understood. Also the cerebellum and cerebral hemispheres resemble each other in being thrown into numerous elevations and depressions, in order to expose a larger extent to the vascular membrane on their surface, which sends its minute branches into them. These circumstances might plead a little for the doctrine that

the cerebellum is connecting with a psychical faculty, whatever that might be, but its totally different source of origin is clearly opposed to such a notion; and we are not left merely to speculate on the subject, for both disease in the human subject, and experiment on animals, teach us that when the cerebellum is destroyed, the power of combining movements so as to regulate and guide them is lost, the limbs being still capable of being moved, but walking and handling being impossible. Thus it is certain that the function of the cerebellum is totally different from what the phrenologists hold it to be.

Examining the cerebral hemispheres in different animals, and proceeding from the lower to the higher forms, a progress in development is found, similar to the progress made in embryonic life. Thus in fishes they are represented by very small parts in the fore part of the brain; in birds they have not extended sufficiently backwards to be in contact with the cerebellum, and their bulk is due almost entirely to the corpora striata; in rodent animals their surface is smooth; and, as one passes to the higher groups of mammals, more and more complicated convolutions of the surface are met with; while in man by far the greatest complexity is found.

Whatever the particular cerebral changes may be which accompany and are necessary for thought, there can be no question that they occur in the gray matter, and that the white matter is only useful by bringing the different parts of the gray matter into communication one with another, an end which it accomplishes very thoroughly by its complicated commissures and countless bundles of fibres taking all directions. Judging, then, from comparative anatomy, and even on phrenological principles, one would expect that, among men, the greater the amount of gray matter of a given quality the more effective would the hemisphere be for the exercise of the mental faculties; and this, there is good reason to consider, is to some extent actually the case. But

the quantity of gray matter varies according to other circumstances besides the size of the skull. The vertical depth at any one spot, from the surface of the gray matter down to the white, differs in different brains; and what is probably more important is, that the complication of the convolutions varies greatly. Complex convolutions are probably more important than the thickness of the sheet of gray matter, because it is obvious that not only quantity but activity of texture will be an advantage; and complexity of convolutions involves increased surface of vascular membrane, sending its blood-vessels into the gray matter, and furnishing its elements with the means of activity. In harmony with this supposition, the simplest condition of the convolutions has been found in the brains of the lowest races of humanity, and Wagner's comparisons of the brains of various persons of ability with others from persons of supposed limited intelligence show more complicated convolutions in the former than the latter, although at the same time exhibiting apparent exceptions to that rule. It may be noticed in this connection that if two skulls of the same cranial capacity be one long and narrow and the other short and broad, the long and narrow one is that which has the greatest amount of surface, and is therefore most favorable for a large proportion of gray matter; so that, *ceteris paribus*, the long skull has probably an advantage over the broad skull; while, on the other hand, there is no doubt that, with a given model of skull to start from, the tendency of expanding hemispheres is rather to increase the breadth than the length.

Turning now to the fundamental doctrine of phrenology, that different parts of the cerebral hemisphere are the organs of different mental faculties, we feel assured that no physiologist will hesitate in giving it a distinct and emphatic denial. It is true that the convolutions of the hemispheres are so constant that they are named; but the existence of the convolutions is not for the sake of dividing the hemispheres into parts, and does not do so, but only affords, as

has been said, facility for vascular supply ; and, at all events, the convolutions have not the smallest correspondence with the phrenological organs which cross them, cut them up, and combine them in the most regardless fashion.

But the fatal objection to the doctrine of different functions in different parts is to be found in the teachings of experiment and pathology. An animal will bear to have its cerebral hemispheres gradually sliced away ; and the slicing may be done in any direction with the same result, namely, gradually increasing stupidity, but with no change of character according as one or other phrenological organ is removed.

So also, persons have often recovered from wounds from which portions of the brain have protruded and been amputated, but it makes no difference what part of the hemisphere is injured ; nor, in cases of tumors destroying portions of the hemispheres, is it at all possible to state the position of the tumors from any alteration in the mental constitution of the patient. The symptoms are perfectly irrespective of the part of the hemisphere affected.

Not only, however, are the hemispheres not divided into organs, but, supposing that such organs existed, it would be impossible to tell their size by the phrenological method. The bulging of any portion of the cranium vault does not indicate an increased thickness of the gray matter at that part, or give any clue to the degree of development of the convolutions opposite to the spot. Indeed, the shapes of skulls indicate differences of form in the central white matter of the hemispheres, rather than local differences of development of the gray matter on the surface. The sheet of gray matter is disposed with tolerably even thickness over great tracts, and always reaches its greatest complication of structure in the same region—namely, towards the back part.

It is not necessary to dwell at length on what has been discussed, *ad nauseam*, long years ago,—how one-half of the

surface of the hemisphere, namely, the part looking to the middle line and to the base, is beyond the reach of all phrenological observation; and how the most minute organs have been crowded by phrenologists over a part of the skull whose configuration is certainly not in the slightest degree affected by the form of the brain, namely, the line of bone immediately over the nose and eyes. But the accompanying figure speaks for itself. It has been obtained by tracing from a horizontal section of a skull, made half an inch above the orbit, dividing the phrenological organs of individuality, size, weight, color, and order, as indicated by Spurzheim, and passing quite above three still more nonsensical organs, viz., that of form, lying on the nasal cavity; calculation, which is never anything but the solid external orbital process of bone; and language, the so-called large size of which is an appearance of the eye dependent on want of projection forwards of the face bone on which it rests.

Turning now to the less special but more generally diffused notions respecting localization of different faculties in different parts of the skull, a few words may be said about fine foreheads. It may be freely granted that a handsome forehead is a beautiful feature, and one frequently, though by no means always or exclusively, met with in persons of talent; but a spacious and well-shaped forehead by no means necessarily indicates preponderance of the frontal lobes of the hemispheres over the others. This, with some other interesting points, will best appear by considering the general shape and mode of growth of the cranium. The cranial cavity, as has been already said, is originally the upper part of a long cylinder, the remainder of which becomes the spinal canal; and it may be regarded, even in its adult state, as a cylinder much modified and distorted. At an early embryonic period it is in all animals curved remarkably downwards on itself. Examining it, however, in adults, the total curvation of the cranial cylinder is seen to differ much in different species, becoming greater the higher the position

of the animal. This increasing curvature is accompanied with increasing expansion of the roof bones of the skull and arrest of the basal bones : thus in the human subject the roof bones are expanded far more than in any other animal, while the basal bones are crowded and even fused together by their position in the concavity of the curve of the cylinder. The human curve is not complete in infancy ; for, as the present writer has elsewhere shown, it goes on, increasing for several years after birth : it is also greater in the higher than in the lower races of mankind. This curvature is an important means of increasing the space for the cerebral hemispheres, by lengthening the roof ; and it does so most effectually when accompanied with the other means which Nature uses to expand the cranium, namely, increase of vertical and transverse diameter of the cylinder.

Farther, before returning to the question of foreheads, it must be pointed out that the position in which the head is articulated with the neck differs in different persons, according to the weight of the fore and back parts, so as to preserve balance. This is best seen in the process of growth, for the forehead and face have the smallest proportional development in young children ; and as they become large, the head is tilted farther and farther round on the top of the vertebral column, so as to throw more weight behind the point of support, to balance the weight in front : and this tilting takes place to a much greater extent in men than in women, because in women the face and forehead remain proportionally lighter.

From the foregoing considerations it must be apparent to every one that loftiness of forehead results from general height of the whole skull, and that the apparent form of the forehead is very dependent both on the amount of total cranial curvature and on the balance of the head on the vertebral column. The deceptiveness of mere general appearance may, perhaps, be best illustrated by noting how people speak of the large foreheads of children. The frontal emi-

nences of the child project forwards, and the head arches boldly above them, giving the appearance of a large forehead ; but, in point of fact, the forehead of the child is proportionally very small and undeveloped ; and its apparent prominence is due partly to the shallowness of the orbits, giving a comparative prominence to the frontal eminences, and partly to the whole skull being so set on the top of the spine that the forehead and face bones are turned more downwards than in the adult. The arch of the upper part of the child's forehead is afterwards lost, because it is turned back to lie more level on the roof of the head. So also, in the female, the head being not so much tilted up, there is a persistent upward arching of the roof of the skull, as it is traced backward, which is peculiarly feminine and graceful.

With regard to development of the back part of the skull, it has been justly remarked by some good observers, that fulness of that region appears to be quite as important as a full forehead ; and it is instructive to note, that if a sketch be made of a head in profile, a change of expression, ranging from almost idiotic weakness to great strength of character, may be produced by varying the outline of the lower occipital region and back of the neck without altering any other portion. But the alteration of that line indicates not a mere addition to the posterior lobes of the brain or subtraction from them, but a change in the anatomy of the whole interior of the head, affecting the cerebral hemispheres throughout their extent.

So, also, those anatomists who have written as if the characteristic posterior lobes of the brain in man and apes were so much matter added to the back of the hemispheres, are really mistaken ; for the hemispheres of a sheep rest against precisely the part of the cerebellum corresponding to that which they rest against in the human subject ; but the human brain differs from that of the sheep in the vastly increased curvature and greater diameter of the cranial cylinder.

In bringing these cursory remarks to a conclusion, it is

only necessary to add, that the reader is not to imagine, because it has been argued that different faculties are not localized in different parts of the cerebral hemispheres, that therefore it follows that there is no connection between the shape of the head and the mental character. Let the reader who still preserves a lingering fondness for judging men by their appearance continue to take the skull into account, if he pleases; but let him be assured that whatever connection really exists is to be explained, not by the phrenological dogma, but as he would explain why massive chins are often conjoined with strong wills, different types of hand with different types of mind, well-built frames with healthy mental tendencies, and rickety bodies with eccentric, though often keenest-witted natures. The explanation is physiognomical.

While, however, this is probably the case with regard to the shape of the head, it is obvious that the relationship of the amount of brain to the mental faculties is more than physiognomical. Possibly an analogy may be drawn between the brain and a galvanic battery, and increase of the gray matter of the one be correctly compared with addition to the cells of the other; but as in an electric instrument the working is dependent on the delicacy and fitness of the arrangements quite as much as on the strength of the current which supplies them, so in the case of the mind the result is dependent on the distribution and balance of the faculties and inclinations, and on other circumstances, none of which are proved to have any connection with the mass of cerebral substance. Certain it is that, although there are probably mental characters peculiar to large and small brains respectively, the size of the skull is, as any observer may easily satisfy himself, no good guide to the mental endowments. — *Popular Science Review*.